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(54) Panels suitable for use as ceiling panels.

(57) The invention relates to a ceiling panel (10) which comprises a profiled sheet-like element (12), including a needlepunched layer (14) of fabric fibres onto which is bonded a moulded resin layer (16) which determines the rigidity and profile of the panel. The panel (10) is specifically intended for use in suspension ceiling applications. The invention extends also to a method of manufacturing panels (10).

FIG 2

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PANELS SUITABLE FOR USE AS CEILING PANELS

THIS INVENTION relates to panels. More particularly, the invention relates to panels suitable for use as ceiling panels and to a method of manufacturing such panels.

It is well known that carpets have often been used as wall coverings and as roof or ceiling coverings, because of their various beneficial properties, particularly when used in larger sized building constructions. More particularly, and because of strict building regulations in many countries, carpets have very good fire retardent properties in addition to the good acoustic and heat insulation properties carpets generally have.

Such carpets, when used as wall coverings and/or as roof or ceiling coverings, are usually directly applied onto the required walls, roofs or ceilings by means of a suitable adhesive, or the like. The carpets are therefore used in their conventional form, as when used as a floor covering, in their normal mode. As such, carpets used as a wall covering and/or as a roof or ceiling covering may be provided in an extended form or, alternatively, may be provided as a carpet tile, or the like.

Because of the natural flexibility of carpets, it will be understood that carpets cannot be used in their natural form unless they can be directly applied onto a rigid support surface such as a wall, a roof, a ceiling, or the like. Carpets, in their normal form, can therefore not be used for suspended ceiling applications and the above defined benefits associated with the use of carpets for the defined applications can therefore not be utilised as such.

It is accordingly an object of the invention to provide a covering for walls, roofs, ceilings, or the like which defines a carpet-like exposed surface and which can be utilised without the requirement of a rigid support surface, onto which the covering must be applied.

According to the invention there is provided a panel which comprises a profiled sheet-like element including a carpet-like first layer of material bonded onto a second layer of material which is substantially rigid and determines the profile of the sheet-like element.

The carpet-like first layer includes a fabric material, which may be a material as is conventionally used for carpets, and which has been processed to define the carpet-like layer, having a desired outer surface profile, by a conventional carpet manufacturing technique. As such, the carpet-like first layer may be formed by weaving, tufting, needlepunching or the like.

A preferred embodiment of the panel of the invention includes a sheet-like element having a first layer, of natural or synthetic fibres, formed into a wad and consolidated by a needlepunching process in which the fibres become entwined with one another to thereby form a continuous layer of material. This first layer may additionally include a backing cloth, such as a scrim cloth, into which the fibres are punched by the needlepunching process.

The second layer of the sheet-like element may be a moulded layer of a mouldable compound such as a suitable resin-like compound, or the like. Typically, the mouldable compound may be styrene butadene rubber resin which is a thermoplastic compound, phenol formaldehide resin which is a thermo setting compound, a suitable acrylic based compound, or the like. The above compounds may have suitable fire retardents added thereto. The first and second layers of the sheet-like element may particularly be bonded together during and as a result of the moulding process of the second layer. Preferably, the resin-like compound of the second layer may be a compound whereby the profile of the sheet-like element is stabilised through thermosetting of the compound.

Further according to the invention, the panel may include a third layer of material formed to enhance the rigidity of the panel. This third layer of material may be of a substance that is in a liquid form when applied onto the second layer of material and which has set after application. Alternatively, the third layer of material may be a planar sheet element secured onto the second layer of the sheet-like element by a suitable adhesive.

As such, the third layer may be a metal, timber, plastics or cardboard sheet. Further according to the invention, the material forming the first, second and/or third layers of the sheet-like element may be materials which render the panel fire retardent.

Furthermore, the profile of the sheet-like element may be such as to enhance the rigidity thereof, the profile essentially being defined by indentations, channel formations, depressions, and/or projecting formations formed with respect to a planar plane which defines the overall plane of the panel. The profile may further be adapted to enhance the appearance of the panel.

Further according to the invention, the panel may be specifically adapted for use as a ceiling panel and, more particularly, the panel may be specifically adapted for use as a ceiling panel in a suspension ceiling construction. Since the panel, in accordance with the invention, is of a rigid construction its use as a panel for a suspension ceiling construction is made possible and, as such, all the benefits of utilising a carpet as a covering is rendered possible. Also, it will be appreciated that such panels need not only be used as panels for a suspension ceiling construction but can also be used by securing panels directly onto suitable support surfaces such as walls, roofs, ceilings, or the like to provide a covering therefor. Even in these modes of application, the use of panels, in accordance with the invention, is preferable over and above the known use of carpets being directly adhered onto support

surfaces, insofar as specific profiles are firstly provided and, secondly, an air-space is often provided between the support surface and the actual panel which has additional insulation benefits.

Further according to the invention there is provided a method of manufacturing a panel, which includes

forming a carpet-like layer of a fabric material by a conventional carpet manufacturing technique;

applying a mouldable compound on one side of the carpet-like layer;

moulding the mouldable compound to form the second layer of material which defines the required profile of the panel and which is bonded to the carpet-like layer of material; and

allowing the moulded compound to set.

The carpet-like layer of material may be formed by a needle-punching process whereby a wad of natural or synthetic fibres are needlepunched to thereby become entwined with one another and form a continuous layer of material. This needlepunch layer of material may clearly also be needlepunched into a backing cloth such as a scrim cloth, or the like. Alternatively, the carpet-like layer of material may be formed by a weaving or tufting process, as is conventionally used for carpet manufacturing.

Further according to the method of the invention, the moulding of the mouldable compound, such as a resin, may be effected by a pressure moulding process by pressing the formed layers of material between opposing mould forms and thereafter allowing the mouldable compounds to set.

The method of the invention further includes, applying a third layer of material onto the moulded layer of material to increase the effective rigidity of the panel. This third layer of material may be of a settable compound applied to the moulded layer in any suitable manner while in a liquid form which is thereafter allowed to set. This settable compound may typically be a compound such as polyurethane, a resin, or the like.

It is specifically anticipated that this third layer of material may be applied by utilising the mould forms used for moulding or similar mould forms, suitably spaced apart to permit the material of this layer to be injected between the mould forms onto the moulded layer of material where it can set. If polyurethane is used for this layer it can be allowed to expand and set between the mould forms. Alternatively, the material of the said further layer may be applied by spraying, pouring, brushing, or the like.

The further layer of material, still alternatively, may be a solid sheet material which is applied to the moulded layer of

material by a suitable adhesive. As such, this further layer of material may be of metal, cardboard, timber, plastics, or the like.

The method of the invention may further include, designing the desired profile of the sheet-like element forming the panel to provide the panel with required rigidity. By utilising the above defined moulding process between a heavy mould press, the accuracy of the required profile can be enhanced and thus the rigidity of the panel.

The method of the invention may further include trimming and finishing the panel. Trimming may be done immediately after moulding while the formed panel is still held between the mould forms.

The method of the invention may particularly provide for the manufacture of a panel which constitutes a ceiling panel suitable for use in a suspension ceiling application.

Further according to the invention there is provided a panel which is manufactured in accordance with the method of the invention as hereinabove defined.

The invention is now described, by way of an example, with reference to the accompanying diagrammatic drawings, in

which :

Figure 1 shows a plan view of a ceiling panel in accordance with the invention;

Figure 2 shows a cross sectional side view of the panel of Figure 1, along line II-II of Figure 1;

Figure 3 shows a detailed cross sectional side view of a portion of the panel of Figure 1; and

Figure 4 shows a schematic cross sectional side view of two opposing mould forms for manufacturing a panel in accordance with the invention.

Referring initially to Figures 1 to 3 of the drawings, a ceiling panel, in accordance with the invention, is generally indicated by the reference numeral 10. The panel 10 comprises a profiled sheet-like element 12 which has a first layer 14 of a fabric material, a second moulded layer 16 of a mouldable compound and a third layer 18 of a settable compound.

The layer of fabric material is, in the particular embodiment, a needlepunched layer comprising a wad of natural or synthetic carded staple fibres consolidated by a needlepunching process, during which the fibres become entwined with one another to thereby form a continuous layer of material. If necessary, depending on the type of fibres used, the needlepunched layer of material may be needlepunched into a backing cloth, such as a scrim cloth (not shown). The outer surface appearance of the fabric layer 14 is optional and is provided by additional needlepunching steps which may, for example, cause looping of the fibres.

The moulded layer 16 may typically be of a mouldable resin such as styrene butadene rubber resin, phenol formaldehide resin, or any acrylic based resin, or a like resin which is applied onto the fabric layer 14 whereafter it is moulded to define the desired profile of the panel 10 and allowed to set. The above resin may have suitable fire retardent substances added thereto. Once set, it will be appreciated that the sheet-like element 12 will be effectively rigid, the formations defining the profile of the element 12 also adding to the rigidity of the entire panel 10. In the particular configuration shown, channel-like formations 20 define circular profiles as shown, the configuration of the formations 20 inhibiting bending of the sheet-like element 12 in the regions where they are defined.

The layer of settable material 18 is essentially an optional layer, which may be of a settable resin or of a material such as polyurethane, and is provided to add to the rigidity of the sheet-like element 12 and thus the panel 10. The actual mode of manufacturing the panel 10 is described hereinafter.

Referring now also to Figure 4 of the drawings, a mould press for manufacturing panels 10 is generally indicated by the reference numeral 30. The press 30 is only partially shown and essentially comprises two opposing mould forms, 32 and 34 respectively, which can be urged towards one another in the direction of arrows 36 as shown.

In order to manufacture a panel 10, a first layer of fabric material is initially provided, this layer typically being a

needlepunched layer as described hereinabove and manufactured in accordance with the steps defined. A mouldable compound such as a liquid resin is next applied onto one side of the needlepunched layer, typically by lick rolling, whereafter the needlepunched layer including the mouldable resin applied thereon is passed through a heated oven in order to permit curing of the resin. Immediately thereafter, the needlepunched layer including the mouldable resin is positioned onto the bottom mould form 34 whereafter the opposing mould forms 32 and 34 are urged towards one another causing moulding of the mouldable compound into the shape defined by the complementary formations of the opposing mould forms. (The configuration of the formations shown is clearly not the particular formations needed to provide the profile of the panel 10). By providing a high pressure press for urging the mould forms 32 and 34 together, the profile can be very accurately formed whereafter the mouldable compound is allowed to set to thereby form the layer 16. The direct result of the moulding process as above described is that the needlepunched layer 14 will simultaneously be bonded to the moulded layer 16.

If the third layer 18 is required, this can be done by merely positioning a spacer between the mould forms 32 and 34 allowing a settable material to be injected between these mould forms 32 and 34 onto the moulded layer 16. A typical material for this purpose may be polyurethane which can be injected and then

activated to cause expansion thereof and setting which is controlled by the spacing of the mould forms 32 and 34. The actual mould forms 32 and 34 used for moulding can be utilised or, alternatively, any other two complementary similar mould forms. Once the third layer 18 is set, the complete sheet-like element 12 can be removed from the mould forms providing a substantially rigid panel.

The Applicants envisage that the various steps of manufacturing a panel 10 as described above could be carried out in various different ways still providing the same or a very similar end product. The specific materials used can also be varied and the particular materials used may be determined by the intended application of the panels so manufactured, fire retardent properties often being required.

The method of the invention also includes trimming the completed panel, a suitable stage for performing the trimming being immediately after moulding while the sheet-like element 12 formed is still held between the mould forms 32 and 34. The exact shape and configuration of the panels is clearly optional and may depend on the intended use thereof.

The particular application for which panels 10 are intended is as ceiling panels and, more particularly, as ceiling panels in suspension ceiling systems. As such, the exact peripheral configuration of the panels and size thereof may be determined

by the intended mode of suspension of these panels, various known modes of suspension of ceiling panels being known to the Applicants and being in general use. Modes of suspension can be conventional or, alternatively, a specific mode of suspension for the panels 10 can be designed to accommodate specifically the panels 10 as described above. Since the mode of constructing suspension ceilings is well known this is not described in any further detail herein.

The panels 10 can clearly also be directly applied onto a ceiling surface, in which case the panels 10 can be adhered to such a surface by means of a suitable adhesive. Particularly for such applications, the third layer 18 of the panel 10 need not conform to the profile thereof but may be a planar layer of material, such as a metal, timber, plastics, cardboard or like sheet of material directly adhered onto the moulded layer 16 by means of an adhesive. This will permit the entire panel to be adhered to the ceiling surface and not merely regions thereof which result from the profile of the panel.

The typical depth of the formations 20 or any other formations may be between 10 and 20mm, the particular depth of these formations also determining the eventual rigidity of the panel 10 in its required applications. It will be appreciated that the formations 20 and the resulting profile of the panel 10 not

only enhance the rigidity thereof but also determine the outward appearance thereof. The outward appearance is, of course, also determined by the surface appearance of the fabric layer 14 and, when used as a ceiling panel, it is believed that the carpet-like appearance may be very suitable because of the resulting acoustic properties of the panel 10.

The Applicants believe that panels 10 having a carpet-like exposed layer of material will have particularly suitable acoustic properties as well as thermal insulating properties and fire retardent properties. As such, panels 10 will be particularly suitable for use in bigger buildings where the use of suspension ceilings is generally used.

The Applicants further envisage that panels 10 can be made in smaller sizes to essentially define ceiling tiles which may be more suitable for use in domestic homes for 'do-it-yourself' purposes.

It will be appreciated that the needlepunch layer 14 may alternatively be a tufted or woven carpet layer which will provide a different outward appearance while still fulfilling the same purpose of the panel 10 as above described. The materials of the moulded layer 16 and settable layer 18 are also entirely optional, the required fire retardent properties of the panel 10 often determining the particular materials used. Panels 10 need clearly not be used only as ceiling panels and may be used for other applications.

CLAIMS

1. A panel which comprises a profiled sheet-like element including a carpet-like first layer of material bonded onto a second layer of material which is substantially rigid and determines the profile of the sheet-like element.

2. A panel as claimed in Claim 1, in which the carpet-like first layer includes a fabric material as used for carpets, processed to define the carpet-like layer, having a desired outer surface profile, by a conventional carpet manufacturing technique.

3. A panel as claimed in Claim 2, in which the fabric material of the first layer includes natural or synthetic fibres formed into a wad and consolidated by a needlepunching process in which the fibres become entwined with one another to thereby form a continuous layer of material.

4. A panel as claimed in Claim 3, in which the first layer includes a backing cloth into which the fibres are punched by the needlepunching process.

5. A panel as claimed in any one of the preceding claims, in which the second layer of the sheet-like element is a moulded layer of a mouldable compound such as a suitable resin-like compound.

6. A panel as claimed in Claim 5, in which the first layer and the second layer of the sheet-like element are bonded together during and as a result of the moulding process of the second layer.

7. A panel as claimed in Claim 5 or Claim 6, in which the profile of the sheet-like element is stabilised through thermo-setting of the mouldable compound.

8. A panel as claimed in any one of the preceding claims, which includes a third layer of material formed to enhance the rigidity of the panel.

9. A panel as claimed in Claim 8, in which the third layer of material is of a substance that is in a liquid form when applied onto the second layer of material and which has set after application.

10. A panel as claimed in Claim 8, in which the third layer of material is a planar sheet element secured onto the second layer of the sheet-like element by a suitable adhesive.

11. A panel as claimed in any one of the preceding claims, in which the materials used for the layers forming the sheet-like element render it fire retardent.

12. A panel as claimed in any one of the preceding claims, in which the profile of the sheet-like element determines and enhances the rigidity thereof.

13. A panel as claimed in any one of the preceding claims, which is specifically adapted for use as a ceiling panel.

14. A panel as claimed in claim 13, which is adapted for use as a ceiling panel in a suspension ceiling construction.

15. A method of manufacturing a panel, which includes

forming a carpet-like layer of a fabric material by a conventional carpet manufacturing technique;

applying a mouldable compound on one side of the carpet-like layer;

moulding the mouldable compound to form a second layer of material which defines the required profile of the panel and which is bonded to the carpet-like layer of material; and

allowing the moulded compound to set.

16. A method as claimed in Claim 15, in which the carpet-like layer of material is formed by a needlepunching process whereby a wad of natural or synthetic fabric fibres are needlepunched to thereby become entwined with one another and form a continuous layer of material.

17. A method as claimed in Claim 16, in which the carpet-

like layer of material is needlepunched into a backing cloth such as a scrim cloth.

18. A method as claimed in any one of Claims 15 to 17, in which moulding of the mouldable compound, such as a resin, is effected by a pressure moulding process by pressing the formed layers of material between opposing mould forms and thereafter allowing the mouldable compound to set.

19. A method as claimed in any one of Claims 15 to 18, which includes applying a third layer of material onto the moulded layer of material to increase the effective rigidity of the panel.

20. A method as claimed in Claim 19, in which the third layer of material is a settable compound applied to the moulded layer in any suitable manner while in a liquid form which is thereafter allowed to set.

21. A method as claimed in Claim 19, in which the third layer of material is a solid sheet material which is applied to the moulded layer of material by a suitable adhesive.

22. A method as claimed in any one of Claims 15 to 21, which includes designing the desired profile of the sheet-like element forming the panel to provide the panel with required rigidity.

23. A method as claimed in any one of Claims 15 to 22, which includes trimming and finishing the panel for its desired application.

24. A method as claimed in any one of Claims 15 to 23, in which the panel constitutes a ceiling panel suitable for use in a suspension ceiling application.

25. A panel manufactured in accordance with the method as claimed in any one of Claims 15 to 24.

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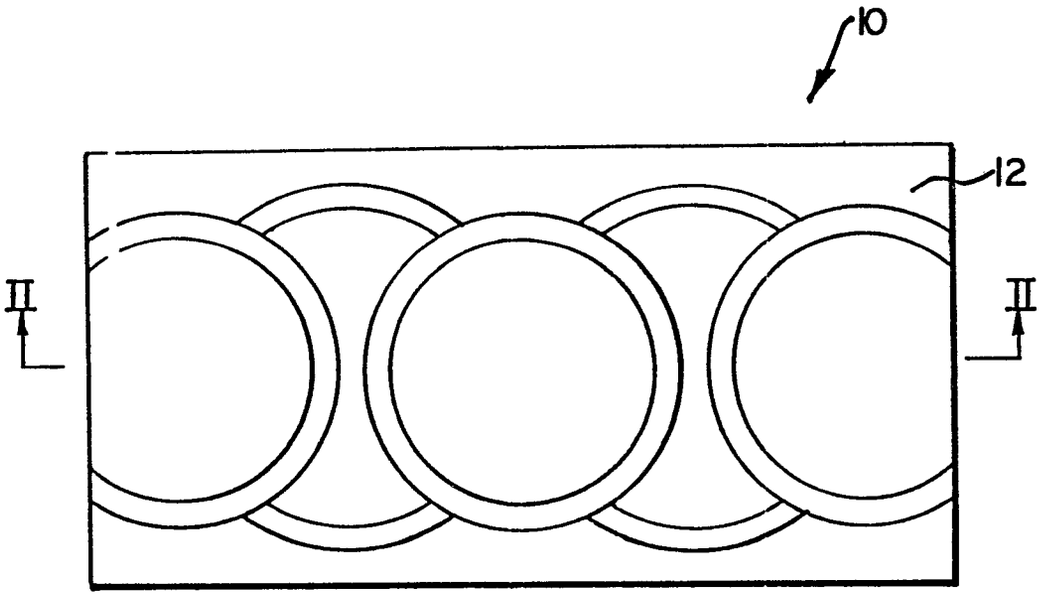

FIG 1

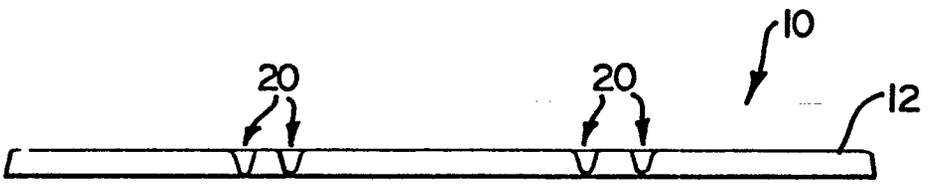

FIG 2

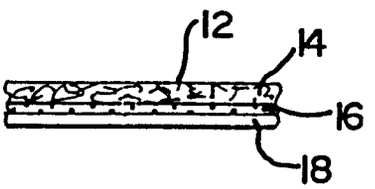

FIG 3

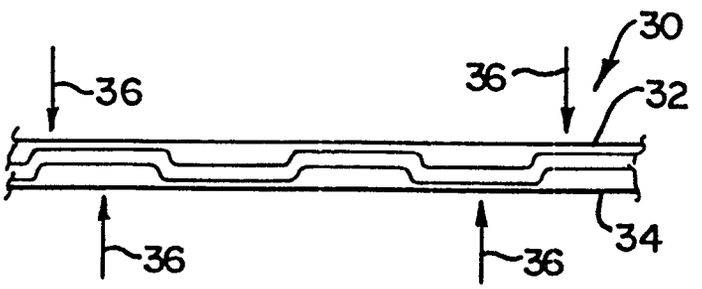

FIG 4